# THE FUTURE OF CONVENTIONAL ARMS CONTROL

James L. Foster

August 1975

P-5489

The Rand Paper Series

Papers are issued by The Rand Corporation as a service to its professional staff. Their purpose is to facilitate the exchange of ideas among those who share the author's research interests; Papers are not reports prepared in fulfillment of Rand's contracts or grants. Views expressed in a Paper are the author's own, and are not necessarily shared by Rand or its research sponsors.

The Rand Corporation
Santa Monica, California 90406

# THE FUTURE OF CONVENTIONAL ARMS CONTROL

James L. Foster

August 1975

Prepared for delivery at the 1975 Annual Meeting of the American Political Science Association, San Francisco Hilton Hotel, San Francisco, California, September 2-5, 1975.

## ABSTRACT

Dramatic changes in conventional military capabilities coupled with nuclear parity should greatly increase the importance of conventional military power as well as raise new opportunities and problems for arms control. Those changes are not yet widely appreciated and, in fact, there is a lack of analytic tools by which to appraise their implications and importance.

As an initial step to systematic analysis of the desirability and feasibility of conventional arms control agreements, this paper describes current trends in weapons development and evaluates alternative interpretations of the implications of those trends. The requirements of effective and reliable arms control agreements are then enumerated and a general assessment made of the difficulties in meeting those requirements.

The conclusions reached are necessarily speculative in light of the limited data and the surprisingly sparse anlaysis available on the characteristics, combat effectiveness and complementary combat and supporting requirements of new conventional weaponry. However, available evidence suggests the imminent emergence of significantly greater incentives for larger conventional forces, for larger logistics and support bases, for surprise attack, and for campaign strategies that emphasize speed and high attrition on all sides. If true, these factors will increase pressures for larger military budgets while also increasing instabilities in arms competitions. They also should increase interest in arms control measures though the characteristics of new weapons technology may make the derivation of such measures even more difficult than in the past.

Since World War II the primary focus of analysts of military policy has been on nuclear weapons and doctrinal developments. In the arms control area this is reflected in the fact that the list of international arms control agreements have been directed almost exclusively to limiting nuclear weapons and the chance of nuclear war. The only partial exception is the Antarctic Treaty which denies the militarization of Antarctica and involves prohibitions against both nuclear and conventional weapons. Currently, the negotiations on mutual force reductions in Europe are the only on-going effort directed at reducing or limiting conventional weapons. Given the relative lack of attention to conventional arms control in the past, the question arises whether the future holds promise for greater interest in and opportunities for limiting the development or deployment of conventional forces. This general question suggests a number of more specific questions: Has anything of importance changed in the strategic environment or in weapons technology that makes conventional forces more interesting than before; if so, do these changes create new or different incentives for conventional arms control and do they make arms control agreements more or less difficult to achieve?

In addressing these questions, the first section of this paper briefly describes the trends in the strategic and technological environment affecting the role and importance of conventional military capabilities. Those trends suggest important defense policy and arms control implications. The relative lack of systematic analysis of those implications is explained in terms of the persistence of certain assumptions about the roles of nuclear and conventional capabilities and the lack of adequate analytic tools for assessing conventional capabilities.

In the second section new conventional weapons technology is evaluated in terms of the potential advantages and disadvantages they present to the U.S. defense posture. Some currently popular arguments about the implications of that technology are critiqued as products of assessments of narrowly defined battlefield effectiveness, of one-sided possession of the technology, and of the cost/effectiveness of individual weapons rather than of total force posture implications of the weapons. Though the force posture and combat capability implications of new conventional weaponry cannot be definitively determined, the available evidence

suggests the imminence of fundamental changes in conventional warfare, changes which present new incentives for arms competitions, for larger forces-in-being, for surprise attack, and for campaign strategies that emphasize speed and high attrition.

These conditions should increase interest in possible arms control measures. The final section outlines the opportunities and requirements for the establishment of such measures as well as the constraints on meeting those requirements. These problems and possibilities are illustrated in a description of several alternative arms control agreements

## The Changing Strategic and Technological Environment

The Hague Conferences of the late nineteenth and early twentieth centuries and the Washington Naval Conferences of the early 1920's represented the high water marks of international arms control agreements limiting conventional weaponry. That was a period of considerable technological change in weaponry as well as of basic changes in the world balance of power. These factors were in no small part responsible for the focus on limiting the development or deployment of the major weapons systems of the day as a means of reducing one source of instability in an already unstable international system.

For the first two decades or so of the post-World War II period significant technological changes in weaponry were, of course, concentrated in the development of nuclear weapons. The world balance of power was conveniently identified with the relative power of the United States and the Soviet Union, who held a virtual monopoly on major nuclear capabilities. These facts, in addition to the potential devastation of nuclear war, served to focus arms control attention on nuclear weapons.

That focus has continued largely unchanged because of the persistence of certain underlying factors: (1) the perception that the United States and Soviet Union remain the dominant forces in world politics; (2) the notion of a bipolar world has continued to rest heavily on the assumption that nuclear capabilities are the fundamental source of differentiation between great and small powers; (3) public debate on weapons developments implies the assumption that the

major technological advances continued to be focused in nuclear weapons; (4) larger conventional forces are viewed by many as attractive because their existence provides an alternative to reliance on nuclear weapons for deterrence and defense; (5) over time there has emerged a "model" of nuclear warfare and nuclear deterrence that has inspired the notion that the implications of new technology and new systems can be assessed with considerable confidence; and (6) there is no generally accepted "model" of conventional warfare by which the specific implications of various weapons systems can be evaluated for their deterrence and warfighting implications--or for their arms control implications.

While each of these factors has served to prolong the particular attention on nuclear arms control, all except the condition covered in the last point are undergoing considerable change. The waning of the assumption of bipolarity has been significantly reinforced by the growing uncertainty about the post-Vietnam, world role of the U.S. and by the rapid development of new regional power centers, as dramatically illustrated in the Middle East. Nuclear parity between the U.S. and the Soviet Union has reduced the credibility of reliance on nuclear weapons for deterrence of other than strategic nuclear attack while the rapid accumulation of conventional capabilities by Third World countries further increases their potential role as a source of instability. While official U.S. policy has, in the past, favored greater conventional forces as a means of raising the nuclear threshold, the increasing costs of conventional forces have cooled the ardor for this position; and arms control advocates have taken up the argument that the experience of the 1960's indicates that improving conventional forces leads to a greater propensity to use those forces--i.e., available means leads to the search for ends to justify use of those means.*

Whether or not this latter argument is accepted, there are a number of possible ways that nuclear parity and the constraints on

---

*see for example Adam Yarmolinsky, The Military Establishment (New York: Harper and Row, 1971) pp. 119-133 for a more balanced argument than most about the relationship of military capabilities to the probability of military involvements abroad.

the nuclear arms race imposed by SALT agreements may have the effect of increasing conventional arms race instabilities and the probability of conflict. For example, the previous instabilities and inequalities inherent in the nuclear arms competition may have had the virtues of dampening incentives for conventional arms races and of decreasing the probability or the scale of conflicts in the Third World. Great Power guarantees were backed, at least implicitly, by the nuclear threat while the threat of escalation to nuclear warfare inspired considerable caution in the manner by which the Great Powers exercised their influence and military power. In addition, Great Power guarantees have acted, in some instances, to offset the threat implied by unequal military capabilities among Third World adversaries and have otherwise served to limit arms transfer demands. Great Power nuclear parity may now remove some of these constraining influences and thus increase the potential for hostilities in conventional arms competitions in the Third World. If nuclear parity serves to diminish the prudence and relative authority of the Great Powers and also the value of their guarantee to Third World clients, then the incentives for and potential instabilities in conventional arms races will increase accordingly.

In addition to the changing relationships of conventional and nuclear weapons to deterrence, conventional weapons technology is realizing fundamental changes. In defending the fiscal year 1975 Defense Department research and development budget, Dr. Malcolm Currie argued: "A remarkable series of technical developments has brought us to the threshold of what I believe will become a true revolution in conventional warfare."*

The history of technological change in conventional weaponry has been marked by slow and steady improvements with infrequent periods of significant breakthrough that have impacted heavily on the character of conventional warfare. There are indications that we are on the threshold of a period of technological breakthroughs. Recent technological

---

*Cited in Phil Stanford, "The Automated Battlefield," New York Times Magazine, February 23, 1975.

advances that have demonstrated particularly significant military effectiveness as compared to prior capabilities include: precision-guided antitank munitions, both ground-based and heliborne; laser-guided munitions; precision-guided standoff aerial ordnance; accurate shoulder-fired antitank weapons using shaped-charge warheads; mobile long-range surface-to-air missiles; and man-portable precision-guided air defense weapons. The potential importance of some of these advances was dramatically brought to world attention by their use during the late stages of the U.S. involvement in Vietnam and during the Arab-Israeli war of October 1973. The full implications of these developments for the nature of conventional warfare generally, for the U.S.-Soviet balance in Europe, and for the stability of potential conflict situations elsewhere have not yet been determined.

A further consideration in judging the importance of qualitative advances in weaponry, and one particularly relevant for the United States, is the cost of these advances. For the foreseeable future, a major dilemma for the United States will be the need to reconcile the growing costs of military manpower and weapons systems with domestic pressures to restrict defense expenditures. The high cost of many new and improved weapons, and the frequent inability to justify those costs in terms of commensurate improvement in capabilities, are principal considerations in favor of constraining technology. Indeed, a superficial view of the dominant features of past and current weapons development trends suggests that weapons are inexorably getting bigger, more sophisticated, more powerful, more provocative and more expensive--without necessarily providing advantages in terms of military effectiveness.

Whether or not this characterization of past development trends is correct, some current developments suggest that past trends may be in the process of reversal. These changes may also make arms control arrangements an even more difficult set of problems than in the past. The nature of those problems is suggested by considering the characteristics of such classes of new weapons systems as precision-guided munitions, remotely piloted vehicles (RPV's) and man-portable anti-aircraft weapons of high accuracy.

(1) Many of them are relatively very "cheap"--cheap to develop, procure, and to operate;

(2) Many are small in size, especially in comparison to the systems they can replace;

(3) They appear to represent a quantum jump in military effectiveness (even when compared to the most expensive and highest performance alternative system);

(4) They greatly increase the fire power and lethality of small and minimally trained forces--precision guided weapons could make a potent force of a terrorist group, guerrilla band, or a small regular or irregular national force;

(5) Many of these new weapons are relatively easy to develop and, for industrialized nations, to develop within existing facilities and by current production methods;

(6) There are few constraints to proliferation given low costs, limited training requirements, and few large or unique logistics and supply requirements for their support;

(7) Even the largest of these weapons, in fact, <u>especially</u> the largest of these weapons can be hidden or effectively disguised to look like currently available weapons or to look like something other than a military weapon. For example, the use of commercial 747s for transporting RPVs creates difficult new problems in identifying the enemy threat or even when an attack is already under way.

If these developments do in fact represent fundamental changes in conventional capabilities, an understanding of their implications for arms control requires systematic analysis of how these weapons may affect the probability or the conduct of conventional warfare as well as the nature of the arms competition:

- Who stands to gain from these breakthroughs and in what ways will they gain? Do they complicate or ease the requirements of a conventional deterrence posture in Europe? Do they offer the U.S. a significant comparative advantage in conventional weapons?
- Do the current technological advances represent only the leading edge of even more fundamental changes in conventional capabilities? Will these new systems compel expensive and elaborate modifications in current weapons and in supporting systems which might inspire a more vigorous "arms race?"

## Is Conventional Arms Control Desirable?

While the changing strategic and technological environment suggests that the importance of conventional forces will be greatly increased, it is not at all clear whether limitations on those forces is desirable. For the U.S., in particular, current trends in conventional arms advances may pose some basic dilemmas arising from conflicting purposes and constraints affecting U.S. arms development policies. Those dilemmas can be illustrated by assessing the implications of conventional arms advances in terms of generally accepted purposes of U.S. defense policies. The following list of purposes, though not exhaustive nor necessarily accepted by all audiences, will service as a basis for an illustrative assessment of force developments:

- to enhance conventional deterrence
- to enhance conventional defense if deterrence fails
- to provide support for allies in their self-defense and in inspiring confidence in the U.S. role as a promoter of "stability"

- to reduce defense costs
- to reduce arms race "instabilities" that may increase the probability of conflict

Definitive assessments of the implications of new conventional weaponry are not yet possible given the lack of data and systematic analysis of the capabilities inherent in that weaponry. However, the thrust of the assessments that have been made is that much of this new weaponry favors U.S. defense objectives and, by implication, should not be the subject of arms control efforts. As will be noted below, those assessments suffer from a number of limitations that make their conclusions suspect: they tend to assume one-sided possession of new technology; they tend to focus on the effectiveness of individual weapons in narrowly contrived battlefield environments rather than on total force posture implications in peacetime and in war; and they overlook the inevitable development of countermeasures.

Deterrence, Defense and Allied Support. In general, the distinction between deterrence and defense is not emphasized in evaluating conventional force postures to the degree it is used in evaluating nuclear forces. A credible conventional deterrent is usually considered to require a demonstrably effective defensive posture, while strategic defense plays little role in current nuclear deterrence postures. New conventional weapons may not only change calculations of defensive capabilities, especially by giving new meaning to the difference between offensive and defensive weapons, but also may break down the symmetry in conventional deterrence and defense capabilities. If these conditions do emerge, then the difference between methods of calculating relative strategic nuclear capabilities and conventional capabilities may disappear in large part. Indeed, conventional weaponry may come to play many of the roles now exclusively assigned to nuclear weapons.

Insofar as deterrence rests on effective defense--i.e. warfighting capacity capable of denying or defeating aggression--there are several ways that an unconstrained U.S. pursuit of technological advantage in

conventional arms might enhance the US deterrence posture. One is to offset potential adversaries' advantages in manpower, geographic position, potential for surprise attack and so forth in order to strike a balance of capabilities. Another way is to improve specifically defensive weapons capabilities relative to capabilities for offensive operations--if there is a valid distinction between such systems. There is a growing belief among a significant number of military analysts that new conventional systems favor the U.S. because they do offset some of the major tactical disadvantages currently faced by the U.S. and because those weapons are primarily "defensive" in nature.

Among the major tactical disadvantages faced by the U.S. are: the relative Soviet advantage in combat units and armor in Europe; the Soviet advantage of geographic proximity to many important, potential conflict areas and the often very great distances from the US to strategically important areas; and the declining availability of US forward-based forces, overseas bases and basing rights (especially in crises). Many proponents of new precision-guided munitions (PGMs), for example, argue that these new weapons systems can effectively offset current and projected manpower and armored vehicles disparities in Europe because they greatly increase the effectiveness of a given force size, especially against armor. In particular, it is argued that anti-tank and anti-aircraft weapons, with wire-guided, infra-red seeker, television seeker or other form of guided warhead, presents a revolutionary "oneshot-one kill" capability. Thus, each soldier becomes a lethal "killer" against major weapons systems; and he is not only more "efficient" but he is also most efficient against those threats which currently find the U.S. at a potential disadvantage.*

The arguments posed are reminiscent of those used in the early phases of developing and deploying tactical nuclear weapons in which one-sided possession was the basis of analysis (implicitly or explicitly) and those weapons were considered a panacea for offsetting NATO manpower and readiness disadvantages. Similarly, with PGMs a one-sided possession that increases the "efficiency" of a given force size may serve to

---

*for an example of this line of argument see James F. Digby, Precision-Guided Weapons: New Chances to Deal with Old Dangers, P-5384, The Rand Corporation, March 1975.

compensate for differences in the sizes of opposing forces. On the other hand, if both sides possess these weapons, then increased efficiency should serve to exacerbate existing differentials in force capabilities arising from unequal force sizes; the smaller force will be even worse off.

PGM proponents have a counter for this argument in the claim that these weapons may improve the efficiency of the "defense" to the detriment of the "offense" whether or not both sides possess PGM's.* The notion is that PGM's, which currently are most effectively employed against armor and tactical aircraft, are peculiarly well-suited to diminishing the capabilities of the primary offensive systems. Relatively small, dispersed units armed with light but very accurate anti-tank and anti-aircraft weapons can effectively blunt an attack. The problem is similar to the problem posed by determining an optimal force deployment for using tactical nuclear weapons: There is no deployment that is effective for both nuclear defense and conventional defense. While dispersed units with PGM's may be a cost-effective means for defending against an armored attack, it cannot effectively defend against an infantry attack. Indeed, infantry sweeps preceding armor may be a very effective means of dealing with a spread defense relying on PGM's.

PGM proponents may counter that, at least, the PGM threat prevents the aggressor from massing his forces for breakthrough offensives which would make his forces a more "visible" and lucrative target. Why is this so? PGM's as currently configured cannot cope very effectively with many forms of cover for attacking forces: smoke, dust, camouflage, dummy units, terrain cover and hiding, and so forth. Furthermore, PGM units are themselves vulnerable to attack and, while the attacker may suffer heavy losses, massing for attack may still be an effective means of breakthrough, especially against thinly spread defenses. At least this seems intuitively more interesting than the suggestion of some that the offense should spread over a wide front. A thinly-spread offensive

---

*Ibid.; Col. Edward B. Atkeson, "Is the Soviet Army Obsolete?" Army, May 1974; and Steven L. Canby, "Regaining a Conventional Military Balance in Europe," Military Review, Vol. 55, No. 6, June 1975. Canby disagrees with Digby's optimism about the inherent advantages of PGM's to NATO but argues that modifications in the NATO force posture can effectively exploit this new technology to advantage.

against a spread defense should present individual defensive units with a more manageable task and make it more difficult for the offense to exploit breakthroughs rapidly.

Rather than improving the NATO-Warsaw Pact balance of forces, the contentions of PGM proponents would seem to make current Warsaw Pact forces relatively more effective. NATO has placed great reliance on expensive, sophisticated tactical aircraft and armored vehicles to blunt a Pact offensive employing many more but less sophisticated tanks and primarily interceptor aircraft. If PGM's are as effective as claimed, then the consumption of hardware will be much higher than in past experience. The experience of the 1973 Yom Kippur War supports this contention.* Therefore, a greater number of less expensive, less sophisticated and expendable vehicles appears optimal. Furthermore, precision-guided anti-aircraft munitions place continued NATO reliance on offensive tactical aircraft in serious question. The Soviets have never placed such reliance on offensive tactical air and they have never allocated significant resources for maintaining and rehabilitating weapons as the U.S. has. The Soviets are programmed to accept heavy losses and to replace whole units with replacement units in a sustained "shock wave" offensive.**

These characteristics of the Soviet forces are derivative of their doctrine of a short war employing blitzkrieg tactics and assuming heavy losses--a doctrine which seems well-suited to the new weapons environment. NATO has always planned for a long war which allows time for U.S. force mobilization and deployments. However, high consumption rates on hardware make forces-in-being and high readiness levels primed for a short, hard-hitting conflict appear optimal. If this is true, the PGM world will require larger, not smaller, NATO forces-in-being in order to pose a credible defense.

---

*For descriptions of the very high rates of munitions and hardware consumptions in the 1973 Middle East War see Aviation Week and Space Technology, October 15-29, 1973; November 5, 1973; December 3, 1973; and Military Review, December 1973 and March 1974.

**For a detailed comparison of NATO and Warsaw Pact doctrine, strategy and related capabilities see Steven L. Canby, NATO Military Policy: Obtaining Conventional Comparability with the Warsaw Pact, R-1088-ARPA, The Rand Corporation, June 1973.

A partial counter to this requirement may be the increased reliance on reservists and militia forces allowed by certain forms of PGM's. Of the current generation of PGM's, many of the anti-tank and anti-air weapons are relatively cheap, employable by a few men, very mobile and require little training for their effective use. Therefore, it is plausible that such weapons can be widely proliferated to irregular or militia forces who would not have to be highly trained or even incorporated into organized units to be effective. Along NATO's central front, militia units could be rapidly mobilized to protect pre-assigned areas and, with PGM's, could harass and slow the advance of Warsaw Pact forces.*

This potential capability, of course, would be available to both sides. Which side could best exploit the capability for rapidly mobilizing irregular forces, reservists and militia? If such a force were essentially capable only of "defensive" operations within a relatively limited geographic area, then they might present an opportunity to NATO. Unfortunately, much of the potential NATO manpower for such an effort must be transported over long distances and this suggests many problems of organization, logistics and the like. Furthermore, if German irregulars along the NATO front are intended to provide a barrier of some kind, their density at any one point may be very low and they are not likely to be well organized to resist regular mechanized troops with substantial artillery and other support. Nor, if mobility for them is a problem, can they be shifted to other sectors where a main enemy thrust is occurring. If large irregular forces are necessary to provide significant defensive capability across a broad front it raises the problems of generating those numbers in some orderly fashion and of protecting them because they are no longer a "fading" force but, rather, an exposed force without the benefit of integral protective capabilities.**

---

*see, for example, Horst Mendershausen, Territorial Defense in NATO and Non-NATO Europe, R-1184, The Rand Corporation, February 1973, passim.

**These arguments are developed by Steven Canby in "Damping Nuclear Counterforce Incentives: Correcting NATO's Inferiority in Conventional Military Strength," Orbis, Spring 1975, pp. 54-55.

Mutual NATO and Warsaw Pact possession of PGM's raises some other peculiar dilemmas. Accurate, long-range air-to-surface and surface-to-surface missiles may be a disadvantage to NATO. Relying on pre-positioned equipment and a large logistics base located in relatively few depots places NATO's readiness and resupply capability in jeopardy of sudden attack by conventional means. The Warsaw Pact is not as dependent on a long and large logistics tail so that the increased vulnerability of that tail is not as critical as it is to NATO. This fact raises a critical question for NATO: can readiness levels be increased in a manner that does not also increase vulnerability to a rapid attack from long and short range?

There are other conventional arms developments which, though not as dramatic in their characteristics as precision-guided munitions, may have at least as important an impact on conventional conflict. They also may be more easily justified as "defensive" weapons, though, again, the case is not clear-cut. Those developments include various forms of "area" weapons; weapons which, unlike PGM's, are directed against concentrations of forces. Among them are air-scatterable mines or minelets which are small, can be dropped over large areas ahead of advancing forces, are difficult to detect and are capable of disabling a tank or other vehicle. Anti-personnel area weapons include cluster-bomb-units (CBU's) which have a large lethal radius against troop concentrations. These weapons types are viewed by some as particularly suited for offsetting U.S. manpower disadvantages in contingencies of large-scale conventional conflict.* How effective they can be without substantial forces of other types is not clear; nor is their presumed, inherent, defensive quality clear-cut unless the defense is, itself, not going to concentrate its forces or employ armored vehicles on a substantial scale. What does seem clear is that these area weapons will underline the speed by which men and materiel will be consumed in battle.

---

*see, for example, Trevor Cliffe, "Military Technology and the European Balance," Adelphi Papers, no. 89, International Institute for Strategic Studies, August 1972, pp. 7-10.

The arguments raised thus far suggest that, whether or not new conventional weaponry is advantageous to NATO, there will be a need for larger, more expendable, higher readiness forces. That is, qualitative advances in certain kinds of weaponry--especially anti-tank and anti-aircraft weapons--may call for reducing the technological sophistication of other weapons--tanks and aircraft--in order to reduce their costs and increase their numbers for a given force. Interestingly enough, the systems to be deemphasized are among the leaders in weapons systems experiencing costly qualitative improvements. Does this argument make such systems prime targets for possible arms control agreements, as suggested by some commentators?*

Answering this question in the affirmative must take account of a number of conflicting considerations. First, if it is most cost-effective to limit some weapons advances, then why should the U.S. not act unilaterally rather than negotiate to make a potential adversary more efficient too? Secondly, the U.S. has, of course, many commitments outside of NATO and the advantages and disadvantages of certain types of weapons systems are not necessarily the same for Third World conflict contingencies. In the Third World, U.S. forward deployed forces are declining, and basing rights may be less available in future conflicts. Where there are constraints on the size of available or deployable forces, then such systems as multi-purpose tactical aircraft may be preferable. Quality may be much more important than quantity against technologically less sophisticated adversaries especially in conflicts where armor is not emphasized, where significant-value fixed targets are not available, where terrain makes target acquisition very difficult, or where massed attack is not emphasized. Where the U.S. mission is to support a local ally providing the essential manpower and defensive operations, the infusion of U.S. technological superiority in the form of weapons may be the most important input and the input most desired by the local ally.

There is an additional argument against limiting any qualitative arms advances which relates more particularly to the problem of deterrence

---

*James F. Digby, "Precision-Guided Weapons. . .", op. cit., p. 25.

than to effective defense. It can be argued that, in assessing comparative technological advantage and costs, it may be misleading to conclude simply that qualitative advances even in questionable performance capabilities are not desirable. In fact, it may be that the uncertainties induced in adversary calculations of U.S. capabilities and vulnerabilities by continued, unconstrained technological advances provide the "cheapest" deterrent capability that the United States can buy. That is, new weapons of uncertain performance characteristics may give a rational adversary planner greater cause for caution in his estimates than weapons with a common technological base and known performance characteristics as might result from a qualitative arms control agreement.

While the implications of precision guidance for tactical, battlefield applications have received the greatest attention from military analysts, precision guidance coupled with long-range command guidance capabilities may have the most profound implications, both for the conduct of conventional warfare and for the role of conventional weaponry in the general deterrence posture. Conventionally armed, long-range air-to-surface and surface-to-surface systems have not been attractive in the past because of the lack of accuracy associated with them. Now, an assortment of glide bombs, remotely piloted vehicles, cruise missiles and rocket-powered surface-to-surface missiles may present the possibility of very effective conventional attacks on what were previously considered strategic targets vulnerable only to nuclear attack. One can imagine the use of large transports of the 747 variety carrying a large number of cruise missiles or RPV's, each with large warheads and capable of hitting targets hundreds of miles away. Such a capability could place even large and relatively "hard" economic and military targets in jeopardy. If such a threat is considered valuable as a deterrent, it could replace similar nuclear capabilities, at least at lower levels of strategic conflict, and, if deterrence fails, it could be used against strategic targets with less collateral damage to non-combatants.

This possibility suggests a decoupling of the presumed symmetry between conventional requirements for deterrence and defense. Deterrence of conventional attack will be less reliant on the threat of either denying success to the aggressor by effective defensive actions or imposing costs

on the attacking force that are disproportional to the potential gains from success. New conventional weaponry for long-range attack presents an inferior defending force with the capability of imposing damage directly on the enemy homeland or on valued assets outside the theater of operations with conventional warheads and at sufficient levels of damage to change the aggressors cost-benefit calculation of success on the battlefied.

If such capabilities are feasible, some will undoubtedly argue that they are beneficial in that they will serve to raise the nuclear threshold while enhancing deterrence. But there must be considerable doubt about such a conclusion. Reliance on such capabilities, especially if defensive forces are allowed to wither, may only increase the chances of rapid escalation. On the other hand, mutual possession of such capabilities may only lead to mutual deterrence but which generates strong incentives for an arms race in strategic conventional capabilities. The instabilities of such a situation may prove to be very much greater than the situation of the past strategic nuclear arms race. In the nuclear field, there is always the caution bred from the fear of mass destruction and there has arisen a more or less generally accepted "model" of nuclear warfare by which advocates and critics of new or increased weapons can evaluate the possible implications of force modifications and employment strategies. There has never been such a "model" of conventional conflict and there is no compelling reason to believe that emerging conventional weapons technology will make such a "model" possible. Thus the questions of "who is ahead?" and "how much is enough to deter?" will be even more difficult in the brave new world of strategic conventional warfare.

Reducing the costs of defense. There are several standard arguments made in support of unconstrained technological development in weaponry by the U.S. First, the U.S. has the most expensive manpower of any army in the world and trading quality for quantity is generally assumed to be in the U.S.' advantage. Secondly, and critical to the first point, the U.S. is generally assumed to have an overall technological advantage in weaponry which has served to offset many other disadvantages. There

are, however, a number of considerations which place these arguments in question.*

Empirical evidence suggests that, over its lifetime, a technology follows an "S"-shaped development curve reflecting increasing returns to scale in the early development period and diminishing returns as the technology matures. Thus, if one side wants to maintain a constant level of technological superiority, it must constantly increase its budgetary allocation to research and development and procurement. Ever-larger defense budgets are no longer politically acceptable and increasing costs of weapons developments could probably only come from reductions in other combat capabilities--thus increasing the gaps that technology is intended to fill.

To right a relative imbalance in capabilities by technological means can be achieved only if the technological leader can improve his capabilities at costs which are no greater than the opponent in his efforts to catch up. However, innovative technology nearly always costs more than imitative developments; the inferior side usually finds it cheaper to catch up than the leader finds it to stay ahead. And, becaue improvements in a given technology cost more over time (as argued above), the leader must rely on discovering revolutionary technological changes to stay ahead at acceptable costs. The problem, of course, is that such revolutionary changes cannot be expected with any confidence.

As a counter to concerns about the costs of weapons developments themselves, some commentators argue that new technologies will lead to overall budgetary savings by replacement of more expensive weapons and by making other particularly expensive weapons virtually obsolete. For example, a frequently expressed argument in favor of such new weapons technology as PGM's is that the relative "cheapness" of PGM's compared to the weapons they attack may, in itself, make the latter weapons obsolete. As one commentator argues: "Tanks and fighter planes may become obsolete. It simply isn't cost-effective. . . to use $20 million

---

*The following arguments draw heavily from Steven Canby, "Damping Nuclear Counterforce Incentive. . ." op. cit., pp. 52-54.

airplanes or $1 million tanks when they can be destroyed by a soldier with a $10,000 missile."* This argument can lead to the conclusion that, even if an offense can be constructed that defeats a PGM-heavy defense, the costs of such an offense are simply prohibitive.

However, to focus on systems costs alone as a criterion of desirability for seeking limits to system development overlooks the possible impact on total budgetary costs of a particular qualitative advance. Whereas a new weapon may have a high unit cost or life-cycle costs in absolute terms and in relation to substitute systems, the total impact on the budget of procuring the new system may be to save dollars relative to other alternatives for performing a given mission. Some important additional considerations include whether they reduce requirements for particularly expensive or political sensitive inputs such as manpower, and whether they reduce the costs of increased readiness, logistics support, and so forth.

However, including some of the points already raised, there are a number of reasons to doubt whether foreseeable trends in conventional weapons technology will be less expensive substitutes for manpower or will reduce overall manpower requirements or costs. There are also many reasons for doubting that new technology will reduce the costs of performing particular missions or of maintaining readiness for key contingencies.

The first generation of PGM's, for example, were relatively cheap to develop and procure. Laser guided bombs initially required only a laser designator and laser-seeker unit that was attached to an existing bomb type and greatly increased the kill probability of the weapon. Given the reduced number of planes, sorties and bombs required to hit a particular target these were very cost-effective additions. The same could be said for shoulder-mounted, guided anti-tank weapons that increased the effectiveness of the individual soldier and reduced reliance on the expensive tank as the primary anti-tank weapon.

Problems arise when account is taken of the relatively plentiful countermeasures for these first generation weapons, of the vulnerability of the launching unit to enemy PGM attack and of the greater associated

---

*Stanford, op. cit.

readiness, support, skilled manpower and other costs of the PGM world. Development of countermeasures itself presents new costs and also presents incentives for rapid development of successive generations to offset enemy countermeasures. For example, small, man-mobile anti-tank guns are rapidly giving way to similar systems mounted on armored vehicles to reduce vulnerability and increase mobility. While the launcher itself may remain relatively cheap, the launch platform quickly raises the total system costs for procurement, operations, maintenance and supply.

In terms of tactical aircraft, stand-off weapons may reduce the necessary sophistication of the launching platform due to reduced vulnerability. However, the ordnance itself, command and control systems and new target acquisition requirements may increase the costs of tactical air missions. In addition, effective long-range air-to-surface capabilities will probably entail greater costs to reduce the vulnerability of logistics facilities.

And these costs will only be a part of the additional costs for logistics given the greater rates of consumption of hardware likely in the new world of conventional weapons technology. Furthermore, as new weapons and their supporting systems become more sophisticated, they will require more skilled, and more expensive, manpower. Thus, even if total manpower requirements are reduced, the total costs of manpower will not be reduced proportionately and may not be reduced at all. Add to this the increased costs of larger and higher readiness forces-in-being and the total budgetary impact of new technology may be quite substantial upward pressure.

Arms Race Instabilities. If the other implications of new conventional weapons technology are unclear, it is even less clear whether that technology may lead to a more vigorous arms race or to instabilities in the balance of forces that increases the probability of warfare. There are certainly strong incentives for rapid competitive technological advances given the potential advantages of unilateral possession of the kinds of systems discussed above and the need to devleop countermeasures for those systems. Surprisingly, some arms control advocates suggest that most of

these new systems are primarily "defensive" in nature yet may also be destabilizing. If they are basically defensive, then even large discrepancies in relative capabilities should not be destabilizing. Concern should be focused on the potential for achieving "decisive" advantage in offensive capabilities, especially those which present incentives and capabilities for surprise attack.

First, it is not at all clear that even anti-tank and anti-aircraft precision-guided munitions favor the "defense" defined in theater-wide terms. In the 1973 Mideast War, the Egyptians and Syrians were able to offset their relative inferiority in tactical air capability by mounting an offensive protected almost entirely by new, mobile, anti-aircraft capabilities. Those capabilities proved to be very effective means for battlefield "defense" of an offensive operation. Similarly, Arab anti-tank capabilities proved very effective in blunting Israeli counteroffensive operations. In the end, in spite of these new systems, rapid counter-offensives emphasizing tanks proved to be the Israelis' best "defense."

Accurate, long-range delivery systems may present new incentives for surprise attack, especially if they can be used to disrupt seriously the enemy's mobilization and logistics systems. But this threat only underlines the increased importance of ready forces-in-being. Indeed, if there is to be a potentially "decisive" element in future conventional warfare, it may be in the relative capabilities for rapid mobilization, deployment and resupply. Again, the 1973 Arab-Israeli war bears this out. The upshot is that a decisive advantage may not be found in technological advances themselves but, rather, in their implications for the more traditional requirements of available manpower, logistics and mobilization capabilities. Given mutual possession of these new technologies, the resulting warfare of rapid and high attrition may give a decisive advantage to the participant, generating superior levels of manpower, hardware and support capacity.

What are the Arms Control Opportunities?

It is not entirely clear from the preceding arguments whether current trends in qualitative conventional arms advances are in the interests of the U.S. and its allies. Nor is it clear that arms control objectives are best served by trying to limit those advances or by exploiting the implications of those advances to limit other military inputs. Judgments about the desirability of various arms control arrangements will depend on the assumptions about the implications of new technology as well as on the specific purposes ascribed to those arrangements. The feasibility and potential effectiveness of alternative arms control agreements will depend on:

1) The identification of points of control in the weapons development, procurement and deployment process;

2) The identification of measures of control that effectively exploit those points of control in placing constraints on particular military capabilities;

3) The availability of verification procedures by which effective execution of control measures can be determined;

4) The availability of credible and effective enforcement procedures.

Points of control might be found, for example, by identifying critical characteristics of weapons systems, or advances in them, that may be subject to effective limitation, and phases within the weapons acquisition process that are most subject to controls. Control of critical weapons characteristics is suggested by the example of laser-guided bombs (LGB), popularly known as "smart bombs." Three technological requirements determine the potential for LGB development: (a) a laser illuminator, (b) a laser spot seeker, and (c) bomb maneuverability capability. If the development of any one of these requirements could be prevented, it would mean effective control over LGBs.

To determine where and when in the weapons development process such controls could be effectively imposed requires drawing distinctions

between phases defined by the kinds of operations, the nature of the inputs required, and the final products of those operations. We would expect to find that different weapons systems and technological research would be subject to varying degrees of control--especially verifiable control--at different phases of the weapons acquisition process. Again referring to the LGB, the limited resource costs, the modest size of the R&D staff required, the ready availability of the necessary technologies, and the ability to conceal operations until a relatively late stage in acquisition may remove it as an item susceptible to effective controls until the stage of large-scale deployments. Even then verification may be quite difficult.

Measures of control might include broad, generalized steps to limit qualitative arms advances generally, steps to limit particular qualitative advances, or steps to limit other military inputs that are necessary to exploit fully the avalability of new technology. Such measures might include:

- Limitations of military expenditures.
- Bans or limitations on development, testing, production, and deployment of the weapons.
- Stretch-out in the introduction of new types of weapons systems.
- Limitations on logistic support systems for certain weapons.
- Limitations on deployments abroad.
- Quantitative limits on certain systems whose value is inreased by new technology or by new systems.

Verifying the effective imposition of control measures is the most difficult problem. Desirable verification measures would satisfy the following conditions.

1) The verification methods must produce unambiguous and credible evidence of breaches of the agreement.

2) The evidence should be visible at the earliest possible stage of development of new or improved weapons systems.

3) The evidence of breach of the agreement should be linked to credible threats of sanctions.

With respect to enforcement procedures, two general types have been most prominent in past arms control agreements. One type involves administration by an international inspection and control body and the other involves essentially self-enforcement measures. Most nuclear arms control measures have relied on a form of the latter type. That is, mutual interests in the benefits of the agreement or mutual fears of the consequences of a breach of an agreement which inspire self restraint are the effective inhibitions against a breach. Though such inhibitions may appear to be a relatively weak assurance against clandestine or open breaches, they may not only be the most effective controls available but also may serve to offset some of the problems of verification. To the extent that reliable self-control mechanisms can be construed, they may reduce, for example, the need for continuous, obtrusive verification of arms policies by outside parties.*

Given these requirements and considerations related to the establishment of effective arms control agreements, it is possible to consider some alternative forms of possible agreements as to their desirability and feasibility. The alternatives to be considered are not exhaustive but, rather, were derived from a particular set of assumptions about constraints on arms agreements as imposed by the characteristics of recent trends in weapons advances. First, there will be very few if any cases where limitations on particular weapons systems can be reliably imposed and verified. Secondly, limitations on research and development will be extremely difficult if not impossible to impose and verify. Third, new weapons systems have undermined the justification for continued and expensive product improvements in such systems as tanks and aircraft. This

---

*One of the few pieces that discuss enforcement mechanisms and particularly self-enforcement mechanisms is Paul Y. Hammond's "Some Difficulties in Self-Enforcing Arms Agreements," Conflict Resolution, June 1962.

will only underline the already visible trend toward self-limitation on those product improvements. Fourth, if new systems will increase the requirements for readiness, forces-in-being, and logistics support, then limitations on those capabilities may offer a point of control and suggest control measures that can be verified less obtrusively and more effectively than limitations on particular weapons.

Cost-saving Agreements. If the purpose of an arms control agreement is to reduce the overall size of the defense budget or, more specifically, the budget for conventional forces, the most direct measure is to impose budget limitations.

There are obvious problems with this approach. The scope and content of military budgets differ widely among nations. Not all budget items relate directly to military capabilities--e.g. Army Corps of Engineers and retirement pay--and not all military-related outputs are covered directly by military budgets. Moreover, the amount of information about military expenditures that is made public is affected by differing conventions of pricing and classification of items. Furthermore, there are distinctions in accounting procedures between spending authority, obligations incurred and outlays. Developing common procedures and conventions confronts the problems associated with divergent, political, economic and bureaucratic structures from which those procedures and conventions are derived.

Furthermore, military expenditures are the product of a complex and not necessarily optimizing process of bargaining within and between those structures. Thus, the level of military expenditures cannot be directly translated into the quality of military outputs, even if those outputs could be measured in terms of comparative international capabilities. Consequently, it is unlikely that participants to an agreement would feel confident that their security is protected by mutual budget constraints, even if military expenditures can be defined, controlled and verified. There will be great concern with the structure of military expenditures and with the relative value of outputs.

If there is a concern with the implications of qualitative arms advances in addition to budget levels, then budget limits pose further

problems depending on the assumptions made about those advances. If U.S. technological superiority is assumed to be a basic U.S. advantage because of attendant gains in efficiency, should the U.S. want to place incentives on potential adversaries to make their forces more efficient as a result of budget limits? In the same vein, if the desire is to limit qualitative advances on all sides, then budget limits may only serve to inspire a qualitative arms race. Only if one assumes that qualitative advances are not cost-effective substitutes for existing forces might budget limits be an incentive for limiting qualitative advances.

Some advances are not clearly cost-effective or have such high price tags as to limit the number that can be produced. In this sense such advances as have been experienced by tactical aircraft have led to price increases that make those advances self-limiting. There is already a movement toward less sophisticated and less expensive aircraft and new anti-aircraft systems only underline the incentives for more, cheaper aircraft. Thus, some of the most expensive may be self-limiting and relatively inexpensive new systems may reinforce incentives for self-limitation.

Technology limitations. If the latter argument is correct, why would the U.S. want a qualitative arms control or a budget limitation agreement? Assuming that existing budget constraints make large, expensive systems self-limiting and that other systems are increasingly cost-effective, what can be gained? One answer might be that the political-bureaucratic system does not respond effectively to economic incentives and that international agreements can be used as a lever against one's own bureaucracy. If this were the purpose then the measure of control is the arms control agreement itself and verification measures become relatively unimportant.

That is, the purpose is to impose more efficient choices on the bureaucracy and to do so at the price of imposing greater efficiency on the adversary. If the adversary chooses not to abide by an agreement that limits non cost-effective systems, then the result can only be more advantageous to the U.S. Thus, if it is concluded, for example, that PGM's

make heavy tanks and multi-purpose tactical aircraft "obsolete" then why not agree to limit or eliminate those "obsolete" systems, especially if entrenched bureaucratic elements refuse to give up cherished capabilities willingly? If the other side breaches the agreement, is there any serious loss? If there is little serious threat resulting from a breach, then such an agreement might be a prime example of a self-enforcing agreement.

Deployment limitations. If verifiable measures of controlling qualitative advances in the R&D and procurement phases of the acquistion cannot be found, then it may be possible to limit total deployments or deployments into particular theaters. This might be particularly relevant for those systems which present opportunities for effective surprise attack. It was argued above, for example, that long-range, air-to-surface and surface-to-surface missiles might provide such an opportunity against the vulnerable U.S. basing and logistics structure in Europe.

However, in spite of the fact that some of these systems are large and distinctive, they may not be "visible" as military weapons. For example, the use of 747's for carrying RPV's or cruise missiles might be difficult to distinguish from commercial aircraft or from military aircraft carrying troop supplies. Thus, the existence of the weapons themselves is difficult enough to verify but it may be even more difficult when they can be openly transported on launching platforms whose contents cannot be verified.

Therefore, it may be easier and even more advantageous to place quantitative limits on deployments of more easily verified capabilities which limit the overall significance of new technology. If the U.S. logistics base in Europe is placed in jeopardy by new systems, why not seek mutual limits on logistics capabilities? Not only would this remove a threatened object but, if both sides reduce these capabilities, it may improve the deterrence posture. As argued above, many new systems raise the likely rate of consumption of munitions and hardware. With a common and an even lower level of consummables, effective offensive operations may be made much more difficult and risky.

Conclusions. In defining what is necessary and desirable in an effective conventional arms control agreement many of the problems may be self evident, but many may not be. For example, in attempting to determine whether it is desirable to limit particular conventional capabilities, we have no convenient means for calculating the implications of various weapons developments or changes in force size. Therefore, contentions about the desirability of certain limitations may have to rest on general arguments about costs or about presumed changes in the level of "tension" arising from increases or decreases in force size or composition. Unlike the arms controller's ability to rely on strategic nuclear exchange models to calculate the implications, say, of an ABM, there is no way to give precision to calculations about the arms race or the "instability" implications of new anti-tank guns or "smart bombs."

On the other hand, the inability to calculate the implications of changes in particular conventional capabilities may reflect the fact that there is no decisive or even particularly significant element in current or possible capabilities. If this is so then non-military considerations, e.g. costs, should be the driving motive of possible arms control agreements and there should be less concern with the problem of verification. That is, if no individual change in capabilities can have a significant effect on the balance of forces, there is both less incentive to promote such change and less fear that one side might breach an agreement and gain unilateral possession. Of course there can be no confidence that decisive advantage will not be gained.

Current development trends in conventional weaponry suggest that these problems may become more acute. Conventional warfare threatens to become more rapid and more ravaging. There are also reasons for believing that incentives for surprise attack may increase and, thereby, increase the instabilities that may inherently accrue from arms competitions. These and other implications of new weapons technology also suggest that, without arms constraint agreements, pressures to increase the size of military forces and of military budgets will grow. While these

propositons may prove to be wrong, there is at least enough supporting evidence to call for concerted, systematic analysis of the implications of current trends in conventional warfare capabilities.